

# Photopoint monitoring: a tool for assessing trends in land cover on hill and high country farms

## Background

Monitoring is the general term that is used to describe the repeat measurement of an environmental variable through time – for example, the level of a soil nutrient or the abundance of a particular plant. Environmental monitoring is widely used in New Zealand for reasons as diverse as assessing the success of animal pest control operations, evaluating restoration plantings, and determining compliance against a resource consent standard.

While much environmental monitoring is undertaken by government agencies, foresters and farmers are increasingly using monitoring in their work. While farmers have routinely monitored variables such as soil nutrient status, animal weight and wool quality, there is increasing interest in using monitoring to quantify broader trends in property condition.

## Why photopoint monitoring?

While a variety of approaches to land cover monitoring are available, for example through the use of permanent plots or aerial photography, photopoint monitoring provides a relatively efficient and effective method that can be readily undertaken by the land manager at little cost. In essence photopoint monitoring involves taking repeat photos of the same scene from the same place over a period of time. If undertaken properly, photopoint monitoring can be used to (1) assess the response of vegetation to a land management activity such as fertiliser addition or change in stocking rate/type, and (2) document long-term changes in land cover on the property.

One of the key reasons for monitoring is that it provides an objective record of change. No matter how good we think we are at observing change, our own assessments are influenced by our perceptions of what we think should be happening, an inability to fully recall what conditions were like in the past, and a failure to compare exactly the same place or in the same season.

Photopoint monitoring has been used successfully in New Zealand for many years and the following notes provide a simple guide to the application of photopoint monitoring in a farming situation, with a special focus on hill country and high country farms.

## Location of monitoring sites

The location of monitoring sites will differ depending on the focus of the monitoring. For example, if monitoring aims to provide a record of overall property condition, then photopoints need to be representative of the range of environments present across the whole property (e.g., alluvial flats and hill slopes). However, if the focus is on assessing the effects of a particular management action, such as fertiliser addition, then monitoring needs to be more focused, perhaps only considering the treated area and a similar untreated area (for comparison).

For monitoring of overall property condition, photopoints need to be spread across the whole property and cover the full range of environments present. Given that land cover is the result of both landform type and management history, these two factors provide a framework for determining photopoint location. Depen-

ding on the size of the property, photopoints might be located in individual paddocks/blocks or for a group of paddocks/blocks with similar landforms and management. Alternatively for very large blocks with more than one landform type, more than one photopoint might be established. The final number of photopoints established will reflect the diversity of the property and the time available for establishing and remeasuring the photopoints. 15–30 photopoints are likely to be sufficient to cover most properties. Too-few photopoints will not provide sufficient information on overall property condition while too-many will most likely result in their never being properly analysed.

Ideally photopoints should be marked permanently (e.g., a fence post or a metal standard). Trees are not good reference points as they can be cut down or blow over. Photopoints should be numbered (e.g., using a permanent label) and, if at all possible, their location should be recorded using Global Positioning System (GPS) technology.

## Procedure for taking initial photos

Two types of photos can be taken from photopoints – panorama and vegetation composition. More than one panorama and/or vegetation composition photo can be taken from the same photopoint depending on where the site is located, but in some cases a photopoint might only be used for one.

**Panorama (or landscape) photos** provide a broad overview of land cover (e.g., on an adjacent hill side). The key consideration for panorama photos is to ensure that the view being photographed will not be blocked out by changes in the foreground in the foreseeable future (e.g., tree growth or new buildings). The photo should be taken with the camera immediately above the photopoint reference. For easy remeasurement, it is useful to include distinctive topographical features in the photo such as ridge lines or creeks.

**Vegetation composition (or close-up) photos** focus on the vegetation in the immediate vicinity of the photopoint and can be used to assess vegetation composition, and the amount of litter and bare ground at a site. These can be combined with quantitative measurements of vegetation cover, although this is not essential. To establish a vegetation composition photopoint two reference points (both marked by metal standards) are required. These should be located 25 m apart and orientated across the slope rather than up or down the slope. The photograph should be taken immediately above one standard with the bottom of the photo-frame defined by a point 2.5 m from the first standard and the top of the photo-frame by the top of the second standard. Photos are best orientated horizontally (landscape mode) and for easy reference,



Photopoint pairs at Avimore Station, Waitaki Valley, showing expansion of briar rose after intensive rabbit control (top) and increased vigour of hard tussock after fertiliser addition (bottom).

a small white-board should be used to record the plot number and date in the photo. The photo can be repeated from both standards, although this is not essential and vegetation composition can be measured in the transect, for example within contiguous 2x2 m plots.

Vegetation composition photopoints should be located:

- At least 20 m from a fence, water trough, tree/hedgerow, track or building (as these modify stock behaviour and hence vegetation composition).
- In an area of vegetation typical of the landform/management unit.
- In a site that is relatively uniform with respect to vegetation, landform and management regime, and preferably on the midslope.
- In a site that is not planned to be disturbed through future management (e.g., avoid locating the photopoint within a paddock that is planned for future cultivation, although a panorama photopoint might be located overlooking such a paddock).

Once the panorama or vegetation composition photo(s) have been taken the following information should be recorded:

- Photopoint number and assessment date and time
- Weather conditions at time of photo
- Vegetation type and for vegetation composition photos 'Top-5' species in vegetation between the two metal standards in descending order of abundance (or more detailed measurements in required)
- Direction of photo (degrees) and brief notes on composition of photo (panorama photos)

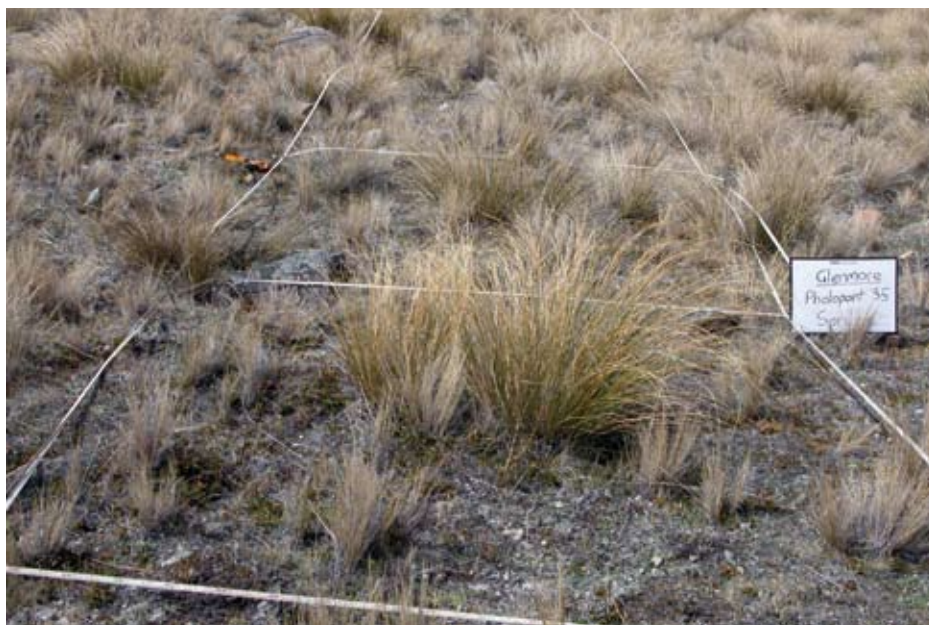
## Procedure for taking subsequent photos

Take copies of the original photos from the site with you to ensure that you photograph the same scene (a folder with plastic sleeves can be a useful way to store these). It is best to take copies of the photos from the original measurement as otherwise a gradual shift in the area photographed can occur. It is essential to spend a little bit of time at each photopoint to ensure that your latest photo covers the same area as the original one (especially for panorama photos).

Photos will normally be taken only once each year and should be taken at the same time of year, a similar time of day, and under similar weather conditions. Spring and autumn are difficult times to take photos as vegetation colour can change rapidly as plants flower and put on new growth, or when vegetation dieback is occurring. The best time is early- to mid-summer, especially December and January.

## Photo analysis and interpretation

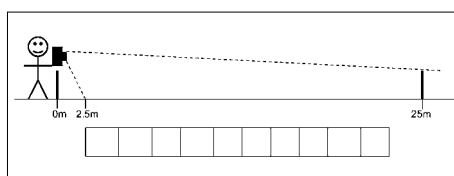
There are a range of options for analysing and interpreting the photos. For panorama photos, the easiest option is a subjective assessment of the major changes observed – e.g., expansion of a woody plant or decreasing area of exposed soil. This assessment might simply be noted by the farmer, but more usefully any changes observed can be recorded on the photo record sheet for future reference. The images can, however, also be analysed either manually or using computer image analysis



Vegetation composition photopoint Glenmore Station, Mackenzie Basin, with 2m wide vegetation monitoring transect



Panorama photo showing spread of Douglas fir in the Queenstown area – 1985 (left) and 2003 (right) (Photos Nick Ledgerd)



Photopoint layout for vegetation composition photo with the 2x20m vegetation measurement transect located 2.5m from the two reference points. Field of view for the camera is indicated by the dotted lines

software to quantify land cover change. For a manual assessment, a grid can be placed over the image (making sure that the images from different years are at an identical scale) and the number of grid intersections striking a particular cover type (e.g., a woody weed) can be recorded to provide a more objective assessment in change in cover abundance.

Similar approaches can be taken to analysing vegetation composition photos. In addition, it is possible to estimate the cover abundance of the dominant species (e.g., tussocks or woody plants) and bare ground, rocks etc in the photo to provide quantitative estimates of ground cover.

## Data storage

Photos need to be properly annotated and stored as soon after they have been taken as is practical. This is important for two reasons; (1) because the longer they are left the more likely they will be deleted, misplaced or lost, and (2) because the observers memory is best immediately after the photos were taken. As it is likely that most photos will be taken using a digital camera, it is recommended that the photos are downloaded and saved onto a computer straight after they are taken. It is best to create a separate folder for each year's photos and then ensure that each image is labelled with the photopoint number and the date the photo was taken. Monitoring data should be treated the same as farm financial records, with backup copies kept away from the computer.

## Fact sheet prepared by:

Assoc. Prof. David Norton, School of Forestry, University of Canterbury, Private Bag 4800, Christchurch. Phone: 03-364-2116. Email: david.norton@canterbury.ac.nz

### Fact sheet no. 1 – August 2006

Integrating economic and biodiversity values in the high country

